EXAMINATION OF LEGAL DOCUMENTS WITH THE MICROSCOPE—QUALIFICATIONS OF EXAMINER.

GEO. E. FELL, M.D., F.R.M.S., Buffalo, N. Y.

This subject is of practical importance, one in which the value of the microscope has again and again been demonstrated. More than once in our own experience has investigation with the microscope cleared up the path of the attorney, ferreted out the work of the contract falsifier, and shielded the innocent from the unjust accusations of interested rogues.

The range of observation in investigations of written documents with the microscope is a broad one. We may begin with the *characteristics of the paper* upon which the writing is made, which may enable us to ascertain many facts of importance; for instance, a great similarity might indicate with associated facts that the documents were prepared at about the same time. A marked dissimilarity might also have an important bearing upon the case.

The differences in the paper may exist in the character of the fibres composing it, the finish of the surface, whether rough or smooth, the thickness, modifying the transmissibility of light, the color, all of which may be ascertained with the microscope.

The *ink* used in the writing may then be examined. If additions have been made to the document within a reasonable time of *its making* it may be well to examine it microscopically, with a great probability of detecting the differences between the original and additional inks. These differences may present as follows: Some inks in drying assume a dull or shiny surface; if in sufficient quantity the surface may become cracked, presenting when magnified an appearance quite similar but of different color to that of the dried bottom of a clayey pond after the sun has baked it for a few days. The manner in which the ink is distributed upon the paper, whether

it forms an even somewhat regular border or spreads out to some extent, are factors which may be also noted. The color of the ink by transmitted or reflected illumination is also a very important factor. This, in one case which I had in hand, proved of great importance and demonstrated the addition of certain words, which completely annulled the value of a document in a case involving several thousand dollars. And in a case where the lines of a document were written over with the idea of entirely covering the first written words, the different colors of the ink could not be concealed from the magnified image as seen under reasonably low powers of the microscope.

We may now consider the appearances presented by the *strokes of the pen* and will note that when a pen glides smoothly without too great pressure the resulting line is comparatively smooth, the ink uniformly distributed and a somewhat uniform outline is presented at the edge of the line. The differences between the strokes produced by an expert and easy writer, as compared with those made by one unaccustomed to the use of the pen, are very noticeable. In the latter case we will find the ink unequally distributed, a greater quantity used and the margin of the stroke will be very irregular as compared with that produced by the able writer. Furthermore, in strokes made with evident care on the part of the writer, or with the intention of copying a signature or bit of writing, there is almost certain to exist an irregular outline to the strokes as compared with the natural easy strokes produced by the same writer under ordinary conditions.

The *point of the pen* modifies the character of the stroke to a marked extent. If the pen has a broad point and smooth or rounded edges the ink is spread evenly and the fibres of the paper are not much disturbed, but if a sharp-pointed pen be used there is apt to be more or less loosening of the fibres in certain points or angles in the writing. If the pen is elastic so that the nibs easily separate we have the nib outline to the stroke with the ink generally evenly distributed between the nib borders of the stroke. In one case coming before me this factor was of very great importance and had much to do with influencing a jury to the rendering of a just verdict. In this case certain experts claimed that these nib strokes

gave evidence that the lines had been retraced in the preparation of the signature, which they claimed to be a forgery, this assertion which the microscope positively disproved, greatly weakened any testimony presented by them.

It has been stated that there is a certain rythm in hand writing peculiar to individuals, so that it may be considered a factor in the investigation of hand writing, a tendency to increase the width of the stroke at certain intervals owing to some peculiar nervous condition of the writer. I have not yet discovered any such interesting feature in any writing I have examined and believe it a matter of so little consequence as to offer no features of practical value.

We may now take up the relative appearance of strokes as seen in ordinary writing and in strokes made at later intervals. As a *general* statement, the last made stroke or crossing stroke will appear above the one first scribed, *e. g.* the down stroke of the loop of the letter "h" will appear above the up stroke. In strokes crossing others and made after some time has elapsed, this feature is much more noticeable and the last made stroke will frequently appear to be raised very much above that first inscribed. Superscriptions to documents on this account are plainly made out with the microscope, and the uselessness of attempting to cover the writing of a document by tracing over the lines by a thick black ink was evident when the microscope was called into a very interesting case which came before some members of this society some years ago (see "Examination of Agreement, Exhibit 'B,'" Vol. VI., page 47.)

In this case three different kinds of ink were used in the document, and each one (the colors varying), lying above the other, could be made out with great clearness.

In the alteration of documents for questionable purposes the ignorance of the value of the microscope in detecting alterations as erasures, leads many to adopt this plan with the view of furthering their schemes. There is no field of investigation connected with this subject more productive of brilliant results than the investigations of *erasures* with the microscope. The common method in making erasures is to use a well sharpened knife-blade and carefully scrape the surface of the paper until the objectionable letter or word has disappeared.

The chemical method of erasing, by which the ink is rendered soluble and quite easily removed from the paper by the aid of a blotter, is also used, although less frequently employed. There are formulæ for several preparations which will in many cases accomplish this object, so that it is quite difficult and in many cases impossible with the microscope to make out the original writing.

With the former method it is almost invariably the case that the work is not complete enough, the erasure is not carried sufficiently far to remove all the particles of the ink of the writing, and I may say here that it would be difficult to do this in any event without the aid of the microscope. The eye of the individual making the erasure is certainly not sufficient, and even with the aid of a good hand magnifier the object might not be effectually accomplished. We will find that the detection of an erasure made by the knife is a very simple matter and may be detected by the novice. An investigation may be made by simply holding the document before a strong light, and is usually all that is necessary to demonstrate the existence of an erasure of any consequence. This is, however, a very different matter from making out the outlines of a word or detecting the general arrangement of the fibres of the paper so as to be enabled to state whether writing has been executed on certain parts of the document. And again, when we enter into the minutæ of the subject, we will find that the compound microscope will give us results not to be obtained by the simple hand magnifier.

Regarding erasures made by chemical preparations, I find that in some instances at least they leave a stain or modify the fibre of the paper so as to leave evidence of the document having been tampered with.

I present two samples showing lines erased in February, 1885, by a chemical preparation; the evidence that an erasure has been made is seen in the stain left in two instances, while by close examination the surface of the paper is seen to be roughened, and in another case the erasure is not complete. It may be stated so far as erasures with the knife are concerned that the microscope will almost always detect the disturbance of the fibres of the paper.

We now come to the consideration of the following problem: Given a document upon which an erasure exists, how shall we proceed to ascertain the letters or word previously written? As in all probability the original ink has not been entirely removed, we may frequently be enabled to trace under suitable powers of the microscope the outlines of the letters by noticing the particles of ink left here and there on the document. If in some instances there is not sufficient ink remaining to do this we may proceed by making out the outline of the letter or stroke by the disturbance of the fibres of the paper, as in erasures made by the knife it is not unusual to find the paper gouged out in the course of the strokes forming the letter. If in an examination for particles of ink upon paper we are not successful the case must not be given up until *different colored light* is used. It will be found that this has an important practical bearing upon the subject, one light obscuring particles of ink of about the same shade or hue, where a different colored light will enable us to clearly distinguish them. In one important case involving thousands of dollars, daylight was necessary, or a light eliminating the yellow rays present in lamp or gas-light.

In the last case mentioned the value of *photography* as an aid in this class of investigations was noted. It will frequently supplement in a most interesting manner the work demonstrated by the microscope.

After establishing the presence of particles of the original ink in an erasure we will find it difficult to associate them so as to make out the erased word or words. This can only be accomplished by making a continuous drawing showing the particles in their relative position, and for this purpose the camera lucida is better than to attempt an off-hand drawing.

An ordinary sized signature magnified fifty diameters gives us a drawing of magnificent proportions, and yet cases will arise, as they have in my experience, where it is necessary to enlarge the full signature to obtain results of importance.

As only a small portion of each letter will present in the field of the microscope, numerous sheets of paper, which may be pasted together after the drawing is made, will be required to make out the signature.

Powers ranging from the two-inch to the one-fourth inch objective will be found useful in investigation of hand writing, and for convenience in observation a large stage is necessary, permitting documents to be folded so that all portions may be examined.

Qualifications of Examiner.

1st. A general knowledge of the use of the microscope, which comprises the judgement born of experience, enabling him to interpret correctly the appearances presented.

2nd. Perseverance in the face of apparently insurmountable obstacles. If you do not make progress by one line of attack, vary your tactics until success crowns your efforts or you have utilized every known means of attack.

3rd. He who will try to make a case where there is evidently no reason in it and will give testimony combatting his truthful opinion with the evident purpose of defeating justice should not be entitled an expert. Honesty of opinion, backed by work supporting it, is golden in these cases and will almost always win.

4th. The ability to give a good and satisfactory answer to every *reasonable* enquiry of the cross-examiner. A sweet, never-to-be-ruffled temper under legal cross-fire, from either the braggadocia, terrorizing, crushing limb of the law, or the gentlemanly, courteous pleader, who will usually make the most out of you.

5th. Another qualification of practical import to the examiner is to obtain your fee before you do your work, or make a satisfactory arrangement to secure it. There is no class of expert work entitled to higher fees than this under consideration. The attorneys will as a general thing look out for their fees and often give the expert who has aided them little consideration.

In the last case in which I took a prominent part, the attorney admitted before I was engaged, that his case was weak and he was uncertain of obtaining any marked advantage for his client. After my work had been completed he acknowledged that the case was placed on a secure basis—"there was no question about the results." The case ended by my client receiving some fifty-three thousand dollars where she expected only ten thousand. Her two attorneys

received fourteen thousand five hundred and ninety-three dollars and some cents in cash, and the one who had admitted the value of my work suggested that my fee should be about one hundred and fifty dollars.

I expect to give details of cases mentioned in this paper in the future, when their practical value will be demonstrated.